UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Larry Lawson, Director
Division of Water Program Coordination
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Mr. Lawson:

The United States Environmental Protection Agency (EPA) Region III is pleased to approve the Total Maximum Daily Load (TMDL) for the aquatic life (benthic) use impairment on the Lewis Creek. The TMDL was submitted to EPA for review in April 2004. The TMDL was established and submitted in accordance with Section 303(d)(1)(c) and (2) of the Clean Water Act to address an impairment of water quality as identified in Virginia's 1998, Section 303(d) list.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The enclosure to this letter describes how the TMDL for the aquatic life use impairment on the Lewis Creek satisfies each of these requirements.

Following the approval of the TMDL, Virginia shall incorporate the TMDL into the Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Peter Gold at (215) 814-5236.

Sincerely,

Jon M. Capacasa, Director
Water Protection Division

Enclosure

Decision Rationale

Total Maximum Daily Loads for
the Aquatic Life Use Impairments on Lewis Creek

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by a state where technology-based and other controls will not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety (MOS), that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA) rationale for approving the TMDL for the aquatic life use (benthic) impairment on Lewis Creek. EPA's rationale is based on the determination that the TMDL meets the following eight regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety.
7) There is reasonable assurance that the TMDL can be met.
8) The TMDL has been subject to public participation.

II. Background

The Lewis Creek Watershed is located in Russell County, Virginia and is part of Tennessee Big Sandy River Basin. The impaired segment runs 4.8 miles starting from its confluence with Stone Branch to its mouth at its confluence with the Clinch River. The 13,959-acre watershed is rural with forested (82 percent) and agricultural (13 percent) lands making up 95 percent of the watershed area. The remainder of the watershed is split between developed (over 1.7 percent) and previously mined lands (2.8 percent).

In response to Section 303(d) of the CWA, the Virginia Department of Environmental Quality (VADEQ) listed Lewis Creek (VAS-P04R) on Virginia's 1998 Section 303(d) list as being unable to attain the general standard for the aquatic life use. This decision rationale will address the TMDL for the impairment of the general standard for the aquatic life use. The failure to attain this use was determined through biological assessments of the benthic

macroinvertebrate community.

Virginia's 305(b)/303(d) guidance states that support of the aquatic life beneficial use is determined by the assessment of conventional pollutants (dissolved oxygen (DO), pH, and temperature); toxic pollutants in the water column, fish tissue, and sediments; and biological evaluation of benthic community data.[1] Therefore, a biological assessment of the benthic community can be used to determine a stream's compliance with the state's general standard for the aquatic life use. Virginia uses EPA's Rapid Bioassessment Protocol II (RBPII) to determine status of a stream's benthic macroinvertebrate community.[2] This approach evaluates the benthic macroinvertebrate community between a monitoring site and its reference station. Measurements of the benthic community, called metrics, are used to identify differences between monitored and reference stations.[3] The state is currently in the process of changing this methodology to a stream condition index (SCI) approach. The SCI is a multi-metric index as well, and is used to evaluate the differences in the benthic community between impaired and reference streams. This approach takes Virginia away from the paired assessment in which an impaired stream is compared to its assigned reference water. The SCI generates a reference condition based on the evaluation of multiple sites.

As part of the RBPII approach, reference stations are established on streams which are minimally impacted by humans and have a healthy benthic community. These reference stations represent the desired community for the monitored sites. Monitored sites are evaluated as non-impaired, slightly impaired, moderately impaired, or severely impaired based on a comparison of the biological community of the reference and monitored sites. Streams that are classified as moderately (after a confirmatory assessment) or severely impaired after an RBPII evaluation are classified as impaired and are placed on the Section 303(d) list of impaired waters for TMDL development. During the 1998 assessment period, Lewis Creek was identified as being moderately impaired. Current analysis using the SCI approach demonstrates that Lewis Creek continues to be a moderately impaired water with scores averaging 47, a score of 60 represents a water that is not impaired.

The RBPII analysis assesses the health of the macroinvertebrate community of a stream. The analysis informs the biologist of the condition of the stream's benthic community. The analysis does not inform the biologist as to what is causing the degradation of the benthic community. Although, further interpretation of biological community can identify likely stressors, additional analysis is required to determine the pollutants which are causing the impairment. TMDL development requires the identification of impairment causes and the

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[1]VADEQ. 1997. 1998 Water Quality Assessment Guidance for 305(b) Water Quality Report and 303(d) TMDL Priority List Report. Richmond, VA.

[2]Tetra Tech 2002. Total Maximum Daily Load (TMDL) Development for Blacks Run and Cooks Creek. Fairfax, Virginia.

[3]Ibid 2

establishment of numeric endpoints that will allow for the attainment of designated uses and water quality criteria.[4] A reference watershed approach was used to determine the endpoints for the Lewis Creek TMDL. Numeric endpoints represent the water quality goals that are to be achieved through the implementation of the TMDL which will allow the impaired water to attain its designated uses. A reference watershed approach is based on selecting a non-impaired watershed that shares similar landuse, ecoregion, and geomorphological characteristics with the impaired watershed. The stream conditions and loadings in the reference stream are assumed to be the conditions needed for the impaired stream to attain standards.

To determine whether a stream was a suitable reference site for the monitored site, the modelers evaluated the topography, soils, ecoregion, landuses, watershed size, and point source inventory of the potential reference site. A reference site candidate was removed if it was identified as moderately or severely impaired in the biomonitoring analysis. The reference site selected for Lewis Creek was Walker Creek.

The next step in the TMDL development process was to determine the loadings and stressors in the monitored and reference watersheds. Low DO, sedimentation, habitat modification, nutrients, and toxic pollutants were evaluated as possible stressors to the monitored stream. Ambient water quality monitoring on Lewis Creek documented temperature, DO, pH, turbidity, total suspended solids (TSS), nitrogen, and phosphorous.

To get a better understanding of the DO concentrations during the most critical periods, early morning DO samples were collected from Lewis Creek on September 10, 2002. The samples were collected from Lewis Creek at the end of the summer season when the lowest DO concentrations were expected to be found due to a combination of high water temperatures (lower solubility of oxygen) and low flows. This sampling also captures the impacts of respiration from primary producers on the stream system. During the evening and early morning hours, these organisms cease photosynthetic operations since there is no sunlight available and consume oxygen. The early morning period is often the most critical as respirtation has been occurring for a longer period of time. The samples were collected between 6:00 a.m. and 8 a.m. both samples had DO concentrations well above the applicable criteria. As a result of this analysis, DO and nutrients were ruled as possible stressors. Nutrients were not seen as a possible stressor since it was believed that the impacts of excessive nutrient loadings would be observed in lower DO concentrations as a result of excess primary production and decay. Ambient water quality monitoring documented low levels of nutrients in Lewis Creek as well.

Toxicity testing was conducted for water samples collected from Lewis Creek. The testing compared the survival and growth rates or fathead minnows (Pimephales promelas) and water fleas (Ceriodaphnia dubia) in water collected from the impaired site with an unimpaired water source. The test did not document any statistically significant effects associated with fathead minnows or water fleas reared in water from Lewis Creek. Toxicity was therefore ruled out as a possible stressor to the system. It should be noted that ammonia was detected at

[4]Ibid 2

concentrations above its acute and chronic criteria. However, this data was collected in the mid 1970s, with the last known violation occurring in 1976. Due to the age of the data, the results of the toxicity testing had a greater weighting.

Sediment and habitat degradation were also analyzed as possible stressors to the benthic community. Habitat assessments conducted by Department of Environmental Quality (DEQ) and George Mason University (GMU) indicated that sediment was a likely stressor. These analyses indicated that intersitial spaces used by benthic organisms for habitat were being blanketed by excess sediment. DEQ has consistently scored Lewis Creek with low embeddedness (extent to which rocks and snags are covered or sunken into the silt, sand or mud of the stream bed), GMU's assessment of the habitat in 2003 verified DEQ's assessment. GMU evaluated the bank stability, vegetative bank protection, and sediment deposition on Lewis Creek as poor as well. An evaluation of the RBPII analysis showed that a more sediment tolerant community was residing in the stream and water quality data indicated elevated levels of turbidity and total suspended solids in some recent sampling. Sampling data from the 1970s revealed even higher levels of TSS and turbidity. Based on the habitat assessment, biological community, and water quality data sediment was viewed as the most likely stressor to Lewis Creek.

The next step in developing the TMDL was to determine the sediment (the stressor) loadings to the monitored and reference segments. The Generalized Watershed Loading Functions (GWLF) model was selected as the means to determine loadings to both waters. The GWLF model provides the ability to simulate runoff, sediment, and nutrient loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land).[5] GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[6] Calculations are made for sediment based on daily water balance totals that are summed to give monthly values. To equate the reference watershed with the monitored watershed, the reference watershed was decreased in size to that of the impaired watershed in the model and the landuses were proportionally decreased based on the percent landuse distribution. Therefore, the landuse breakdown in the reference watershed remained constant.

Local rainfall and temperature data were needed to simulate the hydrology. The Wytheville weather station was used for the Walker Creek model while the Hurley 4S and Lebannon stations were used for the Lewis Creek model. To insure that the models accurately predicted the stream flow the modeled flow results were compared to the observed flows, a process known as calibration. The models' parameters were adjusted based on these results to insure the most accurate representation of the system. The Walker Creek model output was compared to observed data from the United States Geologic Survey (USGS) gage 0317300. The model for Lewis Creek was based on flow data observed at USGS gage 03524000 on the Clinch River in Cleveland. A TMDL was previously developed for the Clinch River and the model was

[5]Ibid 2

[6]Ibid 2

calibrated to the gage in Cleveland. Lewis Creek is a tributary to the Clinch River and part of the watershed monitored by the gage. The results of the models are documented in Section 5.0 of the report. Table 1 documents the TMDL allocations to the impaired segment.

Table 1 - Summarizes the Sediment Allocations for the Lewis Creek

Stream	Pollutant	TMDL (lbs/yr)	WLA (lbs/yr)	LA (lbs/yr)	MOS*(lbs/yr)
Lewis Creek	Sediment	4,247,458	21,732	3,800,653	425,072

* Virginia includes an explicit MOS by reserving the 10 percent of total loading to the MOS.

The United States Fish and Wildlife Service has been provided with copy of the TMDL.

III. Discussion of Regulatory Conditions

EPA finds that Virginia has provided sufficient information to meet all of the eight basic requirements for establishing aquatic life use (benthic) impairment TMDL for Lewis Creek. EPA is therefore approving this TMDL. EPA's approval is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to meet the applicable water quality standards.

The impaired segment was listed as impaired due to a degradation of its benthic macroinvertebrate community. As mentioned above, benthic assessments inform the biologist of an impairment, but they are unable to identify stressors conclusively. Through a careful analysis of water quality monitoring data, habitat assessments, and the biological community, Virginia determined that excessive levels of sediment are causing the degradation of the benthic community in the Lewis Creek. The Commonwealth does not have numeric standards for sediment at this time. Therefore, the loading obtained from the reference watershed was used as the endpoint for the TMDL. Its believed that if the sediment load on Lewis Creek can be reduced to that of the area weighted reference watershed, the impairment to the benthic community will be relieved.

The GWLF model was used to determine the loading rates of the stressor (sediment) to the streams from all point and nonpoint sources. The TMDL modelers determined the applicable stressor loading rates within each watershed. Data used in the model was obtained on a wide array of items, including landuses in the area, point sources in the watershed, weather, stream geometry, etc..

The GWLF model provides the ability to simulate runoff and sediment loadings from watersheds given variable source areas (e.g., agricultural, forested, and developed land). GWLF is a continuous simulation model that uses daily time steps for weather data and water balance calculations.[7] To equate the reference watershed with the monitored watershed, the reference

[7]Ibid 2

watershed was decreased in size to that of the impaired stream in the model. Each landuse was decreased in equal proportion, insuring that the landuse breakdown in the reference watershed remained constant. Local rainfall and temperature data were needed to simulate the hydrology, this data was obtained from local National Climatic Data Centers weather stations. In the GWLF model, the nonpoint source load calculation is affected by terrain conditions, such as the amount of agricultural land, land slope, soil erodibility and farming practices used in the area.[8] Parameters within the model account for these conditions and practices. Lewis and Walker Creeks were modeled to the flows observed at a USGS gages. Walker Creek was calibrated to observed data from 1981 through 1999 while the Lewis Creek was calibrated to observed data from 1991 through 2002. The TMDL is based on the flows and loads from 1991 through 1999 when the modeling efforts overlapped. The TMDL is based on the average annual sediment loads of the seven and a half year modeling period. The first few months of 1991 were not considered as this was needed for the model setup.

EPA believes that using GWLF to model and allocate the sediment loadings to the impaired stream segments will ensure the attainment of the designated uses and water quality standards on Lewis Creek. Unlike previous TMDLs, streambank erosion was not quantified in the TMDL because of a lack of data.

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

Virginia indicates that the total allowable loading is the sum of the loads allocated to land based precipitation driven nonpoint source areas (forest and agricultural land segments) and point sources. Activities that increase the levels of nutrients and sediment to the land surface or their availability to runoff are considered flux sources. The actual value for total loading can be found in Table 1 of this document. The total allowable load is calculated on an annual basis since it is the annual loading that impacts the benthic community the greatest.

Waste Load Allocations

Virginia has stated that there are two regulated point sources discharging to the impaired segment. One of the facilities is a municipal treatment system, the other is a mining operation with seven discharge points and two National Pollutant Discharge Elimination System Permits (NPDES). The Honaker Sewage Treatment Plant (STP), has a design flow of 200,000 gallons per day (gpd) and a TSS limit of 30 mg/L. The facilities waste load allocation (WLA) can be determined by multiplying the sediment concentration in their effluent by their daily flow by 365 days after appropriate conversions are made. The eight mining outfalls are allowed to discharge TSS at a concentration of 35 mg/L and their design flows are all less than 10,000 gpd. Their WLAs can be determined in the same manner as the Honaker STP. Table 2 documents the

[8]Ibid 2

WLAs for the NPDES permitted facilities in the Lewis Creek Watershed. None of these facilities were required to reduce their loading as a result of the TMDL. Point sources make up less than one percent of the total sediment load to Lewis Creek.

EPA regulations require that an approvable TMDL include individual WLAs for each point source. According to 40 CFR 122.44(d)(1)(vii)(B), "Effluent limits developed to protect a narrative water quality criterion, a numeric water quality criterion, or both, are consistent with assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA pursuant to 40 CFR 130.7." Furthermore, EPA has authority to object to the issuance of any NPDES permit that is inconsistent with the WLAs established for that point source.

Table 2 - TSS WLAs for the Lewis Creek

Facility	Permit Number	Permitted Flow (gpd)	Permitted Concentration (mg/L)	TSS Load (lbs/yr)
Honaker STP	VA0026387	200,000	30	18,276
Harold Keene Coal Company (HKCC)	1201497	300	35	35.31
HKCC	1201497	7,200	35	767.61
HKCC	1200614	7,200	35	767.61

HKCC	1200614	1,000	35	104.4
HKCC	1200614	6,600	35	706.2
HKCC	1200614	7,200	35	767.61
HKCC	1200614	1,400	35	153.52
HKCC	1200614	1,400	35	153.52

Load Allocations

According to Federal regulations at 40 CFR 130.2(g), load allocations (LAs) are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting loading. Wherever possible, natural and nonpoint source loads should be distinguished.

In order to accurately simulate landscape processes and nonpoint source loadings, VADEQ used the GWLF model to represent the impaired watersheds. The GWLF model is a comprehensive modeling system for the simulation of watershed hydrology, point and nonpoint source loadings, and receiving water quality. GWLF uses precipitation data for continuous and storm event simulation to determine total loading to the impaired segments from the various landuses within the watershed. Table 3 provides the LA for all of the nonpoint sources of sediment if the recommend TMDL option is used. There were two other options developed one which required no reductions from developed lands and the other which required no reduction from agricultural lands. Although previously mined lands represented only a small portion of the total watershed, less than three percent by area, they were the largest source of sediment to Lewis Creek. In order to successfully reduce the sediment loadings to Lewis Creek reductions were required from this landuse.

Table 3 - LA for Sediment for the Lewis Creek

Land Use	LA Sediment (lbs/yr)	Percent Reduction
Forest	302,028	0
Pasture Hay	1,412,700	33
Cropland	555,340	33
Previously Mined Lands	1,421,098	80
Urban	109,486	33

3) The TMDL considers the impacts of background pollution.

The reference watershed approach inherently considers the impact of background pollutants by considering the sediment load from all landuses, including forested lands, within the impaired and reference watersheds.

4) The TMDL considers critical environmental conditions.

According to EPA's regulation 40 CFR 130.7 (c)(1), TMDLs are required to take into account critical conditions for stream flow, loading, and water quality parameters. The intent of this requirement is to ensure that the water quality of the impaired segments is protected during times when it is most vulnerable.

Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards[9]. Critical conditions are a combination of environmental factors (e.g., flow, temperature, etc.), which have an acceptably low frequency of occurrence. In specifying critical conditions in the waterbody, an attempt is made to use a reasonable "worst-case" scenario condition. For example, stream analysis often uses a low-flow (7Q10) design condition when the ability of the waterbody to assimilate pollutants without exhibiting adverse impacts is at a minimum.

The GWLF model was run over a multi-year period for the reference and monitored watersheds to insure that it accounted for wide range of climatic conditions within the watersheds. The allocations developed in the TMDL will therefore insure that the criteria is attained over a wide range of environmental conditions.

[9]EPA memorandum regarding EPA Actions to Support High Quality TMDLs from Robert H. Wayland III, Director, Office of Wetlands, Oceans, and Watersheds to the Regional Management Division Directors, August 9, 1999.

5) The TMDL considers seasonal environmental variations.

Seasonal variations involve changes in stream flow and loadings as a result of hydrologic and climatological patterns. In the continental United States, seasonally high flows normally occur in early spring from snow melt and spring rain, while seasonally low flows typically occur during the warmer summer and early fall drought periods. Pollutant loadings also change during the year as vegetation grows making it more difficult for sediments to runoff. Consistent with the discussion regarding critical conditions, the GWLF model and TMDL analysis effectively considered seasonal environmental variations through the use of observed weather data over an extended period of time and modifying the soil loss equations based on the time of the year.

6) The TMDL includes a margin of safety.

This requirement is intended to add a level of safety to the modeling process to account for any uncertainty. The MOS may be implicit, built into the modeling process by using conservative modeling assumptions, or explicit, taken as a percentage of the WLA, LA, or TMDL. Virginia includes an explicit MOS by allocating 10 percent of the total TMDL loading to the MOS.

7) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. WLAs will be implemented through the NPDES permit process. According to 40 CFR 122.44(d)(1)(vii)(B), the effluent limitations for an NPDES permit must be consistent with the assumptions and requirements of any available WLA for the discharge prepared by the state and approved by EPA. Furthermore, EPA has authority to object to issuance of an NPDES permit that is inconsistent with WLAs established for that point source.

Nonpoint source controls to achieve LAs can be implemented through a number of existing programs such as Section 319 of the CWA, commonly referred to as the Nonpoint Source Program.

8) The TMDL has been subject to public participation.

The public participation process for the Lewis Creek TMDL commenced on April 10, 2003 with a stakeholder and TMDL study kickoff meeting. There were two public meetings held for the TMDL at the Honaker Town Hall in Honaker, Virginia. The first meeting was held on June 26, 2003 from 7:00 p.m. to 10 p.m. the second was held on February 12, 2004 from 7:00 p.m. to 10 p.m. The documents and meetings were all advertised in the Virginia Register and opened to a thirty-day comment period.